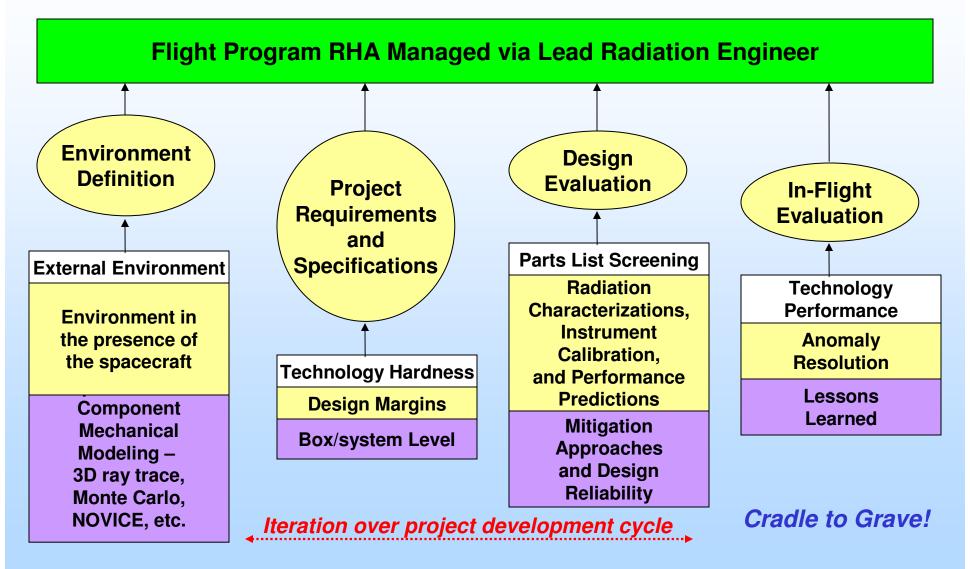
# Flight Program Radiation Hardness Assurance (RHA) Flow by REAG





### NASA/GSFC Radiation Effects and Analysis Group (REAG)-Radiation Effects Research (RER)

### **RER Focus Areas of REAG – Top-level Current and Recent Efforts**

Environment Modeling and Tools

Solar and Trapped Particle Models

Technology Damage Tool

Physics-Based Tool Suite (w/Vanderbilt)

Advanced
Microelectronics
Evaluation and
Modeling

Ultra-high Speed
-SiGe and competing technologies

Test Technique and Equipment Development

Hardened Technology
Evaluations

Ultra-scaled and Low Power Electronics

COTS RHA

Lessons Learned, Application, and Test Guidance Documents

COTS Evaluations – Memories, Processors, FPGAs, ADCs, NVMs, etc.

Scaled CMOS Evaluation

RHA Issues – Single Event Transients (SETs), etc. Photonics and Imaging Technologies

Fiber Optic Links – Component Test Guideline and Characterization

Visible and IR
Array Evaluation,
Modeling, and
Lessons Learned

Consultation Services

We also perform technology needs and readiness studies as well as develop and track flight experiments.

## **REAG - Work Areas Alternate View**



#### **Electronics Effects**

#### **Single Event Effects**

- Research (Device Physics)
- Research (Engineering)
- Project Specific Tests
- Terrestrial Effects

#### **Total Ionizing Dose**

- Research
- Project Specific Tests

#### **Displacement Damage Effects**

- Research
- Project Specific Tests

#### Specialty/Technologies

- Photonics
  - Fiber Optics (O/E)
  - Optical Fibers
  - Imagers, IR Arrays,
     Focal Plane Arrays (FPAs)
- Materials
  - Shielding Properties and Interaction Physics
- Hybrid Devices
  - DC-DC Comverters, Optocouplers
- Specialty Electronics
  - FPGAs, Processors, Memories
  - High-speed and low power
  - Advanced Mixed Signal, ADCs
- ·Scaled CMOS, SOI, and Power Devices

#### **Radiation Environment**

- Research/Modeling
- Mission Specific Analysis
- •3-D Ray Traces
- Terrestrial/Avionics Environment
- Tool Development

#### **Data Dissemination**

- Website
  - Test Data
  - Papers
  - Warnings
  - Background Information
- Publications
- Training Courses
- NASA/GIDEP alerts

#### **Ground Radiation Test Facilities**

- GSFC Radiation Sources
  - Van de Graaff accelerators

Co-60 Chamber

**Alpha Source** 

Offsite

#### Heavy Ions: NSCL, BNL, TAMU, LBNL

Microbeam: SNL

**Proton: IUCF RERP, UCD CNL** 

#### **Flight System Support**

- Lead Project Engineers
- Predictive Tool Development
- NASA Issues
- Mitigation Methods
- Mission Specific Analysis
- Guidelines Documentation

#### **Flight Experiments**

- Commercial Electronics
- Photonics/FPAs
- Flight Dosimeters
- Engineering Data Analysis

#### **Instrument Calibration**

- Proton/Electron
  - (low energy on site)
- Proton/Electron
  - (high energy off site)

#### **Material Damage**

- Proton/Electron
  - (low energy on site)